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Method for Producing Hydrogen Combined with Gasification Combination  
Generation System

[Gasuka Fukugōhatsuden Shisutemu to kumiawaseta Suiso Seizō Hōhō]

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**[Claim]**

**[Claim 1]** A hydrogen production method that is used to produce hydrogen by electrolysis of water, the invention characterized as using a byproduct of oxygen as an oxidant for a combination generation system and at the same time using the energy generated by this gasification combination generation system to produce hydrogen;

**[Claim 2]** The composition of Claim 1, wherein the aforementioned oxygen byproduct is used as an oxidant in either a combustor of the aforementioned gasification combination generation system or in a gasification furnace.

**[Detailed Description of the Invention]**

**[0001]**

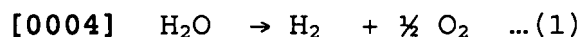
**[Industrial Field]** The present invention relates to an oxygen-producing method that produces oxygen by electrolysis of water and in particular to an oxygen-producing method that uses the oxygen product as an oxidant for the gasification combination system and uses the energy generated by this gasification combination system.

**[0002]**

**[Description of the Prior Art]** There have been proposals for a plan for producing oxygen from water by electrolysis using a variety of types of energy (including wind power, tidal power, and other types of energy) that can be reproduced and by supplying the oxygen to

regions where a great deal of energy is consumed, thereby contributing to effective use of energy on a global scale.

[0003] In general, water is hydrolyzed as indicated in the following formula in the oxygen production process and hydrogen and oxygen are produced.



[0005]

**[Problems That the Present Invention Is Intended to Solve]** In this hydrogen production method, 50% (mol base) of the oxygen in the hydrogen ( $\text{H}_2$ ) that has been produced will inevitably be produced as a byproduct of the hydrogen producing process, as can be seen from the reaction formula (1). There is presently, however, a problem in that there is no specific way in which this oxygen can be used effectively.

[0006] Therefore, it is an object of the present invention to provide a hydrogen production process in which oxygen as a byproduct can be used effectively.

[0007]

**[Means Used to Solve the Problem]** The invention as described in Claim 1, which attains the aforementioned objective, is configured so that the oxygen of a byproduct is used as an oxidant of a gasification combination generation system, and at the same time, the energy produced by this gasification combination generation

system can be used to produce hydrogen in the hydrogen production method that is used to produce hydrogen by hydrolyzing water.

[0008] The invention as described in Claim 2 is configured so that the aforementioned oxygen of the byproduct can be used as an oxidant in the combustor of the aforementioned gasification combination generation system or in the gasification furnace.

[0009]

[Mode of Working the Invention] Next we shall explain a suitable mode for working the present invention by referring to figures.

[0010] In Figure 1, H<sub>2</sub>O electrolysis plant 1, which is used to produce oxygen by electrolysis of water is indicated schematically when combined with the gasification combination generation system 7.

[0011] As indicated in Figure 1, a gas gasification purification device 2, which is used to purify gasified gas is connected on the downstream side of the H<sub>2</sub>O electrolysis plant 1. A combustor 3, which is used for combustion of the gasified gas generated, is connected to the downstream side of the gasification gas purification device 2. A gas turbine 4 is connected to the combustor 3 and a generator 5 is connected to the gas turbine 4. Then, generator 5 and H<sub>2</sub>O electrolysis plant 1 are connected by electric power transmission line 6.

[0012] Furthermore, the aforementioned gasification gas generator 2, combustor 3, gas turbine 4, generator 5, and other devices

(gasification furnace and the like) not indicated in the figure make up the gasification combination generation system 7.

[0013] Water ( $H_2O$ ) is connected on the  $H_2O$  electrolysis plant 1 and at the same time is hydrolyzed (see reaction formula 1), and hydrogen ( $H_2$ ) and oxygen ( $O_2$ ) are generated. The hydrogen generated is converted to a medium that can be transported and is then transported. Meanwhile, the oxygen is introduced to the gasification gas-purifying device 2 of the gasification combination generation system 7.

[0014] Meanwhile, in gasification combination generation system 7, coal and other fuels are likewise introduced to the gasification furnace (not indicated in the figure) from the fuel supply device (not shown in the figure) and the gasified gas generated is introduced to gasified gas-purifying device 2. In other words, in gasified gas-purifying device 2, the oxygen produced in the  $H_2O$  electrolysis plant 1 as indicated above is introduced as an oxidant for gasification and at the same time the gasified gas is introduced. In addition, the  $SO_x$  and other undesirable constituents that are contained in the gasified gas are removed from the gasified gas.

[0015] Furthermore, in the gasified gas-purifying device 2, part of the  $H_2O$  in the gasified gas may be converted to hydrogen, the hydrogen is enriched, and the water content is separated from the gas, which is rich in hydrogen.

[0016] The gasified gas that is gasified and purified in the gasified gas-purifying device 2 is introduced to combustor 3, burned there and the gas turbine is driven and the gas is discharged into the air.

[0017] Generator 6 is driven by gas turbine 4 and generation takes place. The electric power generated is sent to the H<sub>2</sub>O electrolysis plant 1 by electric power transmission line 6 and is used for electrolysis of the water in the H<sub>2</sub>O electrolysis plant 1. The O<sub>2</sub> generated in the electrolysis of the water is again sent to the gasification combination generation system and the aforementioned process is repeated.

[0018] If the amount of oxygen obtained in the electrolysis of the water is less than the amount of oxygen required in the gasification combination generation system 7, the amount lacking, needless to say, will be supplied to the gasified gas separately using a blower.

[0019] In the present invention, oxygen that is generated as a byproduct in the hydrogen production process can be used effectively as an oxidant of a gasification combination generation system. At the same time, the electric power obtained by this gasification combination generation system can be used for electrolysis in the hydrogen production process. As a result, the invention accomplishes two things at the same time and transportation costs can be reduced. It is especially advantageous

in that the present invention makes it possible to efficiently convert fossil fuels to clean hydrogen energy with high added value at fossil fuel production sites.

**[0020]**

**[Effect of the Invention]** The hydrogen production method that is combined with the gasification combination generation in the present invention is characteristic in that the oxygen generated as a byproduct in the hydrogen production process can be effectively used as an oxidant for the gasification combination generation system. At the same time, the electric power obtained by this gasification combination generation system can be used for electrolysis in the hydrogen production process so that two tasks may be taken care of simultaneously, thereby reducing transportation costs. The present invention is particularly advantageous in that fossil fuels can be efficiently converted to clean hydrogen energy with high added value at fossil fuel production sites.

**[Brief Explanation of Figures]**

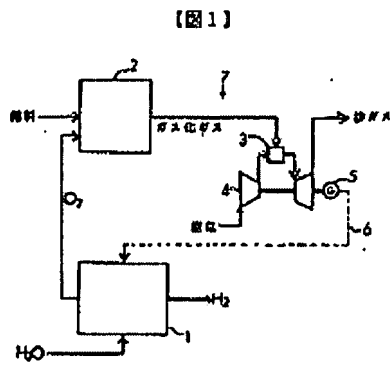
**[Figure 1]** A schematic diagram of the H<sub>2</sub>O electrolysis plant, which is combined with the gasification combination generation system.

**[Explanation of Notation]**

- 1 H<sub>2</sub>O electrolysis hydrogen plant
- 3 Combustor
- 7 Gasification combination generation system



[Figure 1]



[captions:

Left upper side: "fuel"

Upper middle: "gasified gas"

Upper right hand: "exhaust gas"